



# Systems Engineering – A Global Perspective

## Town Hall Meeting on Systems Engineering



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**Underlying “TONE” for this Presentation**

**Idealistic or Realistic (Actually, Cynical)**

**The Contextual Setting for this Presentation**

**“Rear View Looking” or “Forward Looking”**

# Critical “Cause and Effect” Considerations in the Commercial Industry: A Workstation Developer

- Greater emphasis on “stakeholder requirements” (concept of the BRR)
  - Tools to formalize the translation of stakeholder requirements into system requirements (both, functional and non-functional requirements – concept of the SRR)
  - Inclusion of issues such as testability, serviceability into Step 2.
  - Definition of consistent design and development “artifacts” (documentation) – Less personality dependence
  - Tools for formal requirements traceability and allocation to test
  - Architecture – modeling, analysis, and assessment
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- Cause-and-Effect
- Higher than expected test, integration, and verification times
  - “Delta” between “features/scope proposed” and “features/scope delivered”
  - Concept of validation absent - traceability to primary stakeholder/ customer requirements
  - Significant requirements and scope flux
  - Higher than desirable warranty costs
  - Higher than desirable service and support costs and times
  - Higher than desirable upgrade and scaling costs
  - Higher than desirable operational costs

# Systems Engineering – Expectation

- ❖ **Successful implementation of proven, disciplined systems engineering processes results in a total system solution that is:**
  - **Robust to changing technical, production, and operating conditions;**
  - **Adaptive to the needs of the users; and**
  - **Balanced among the multiple requirements, design considerations, design constraints, and program budgets.**

# Some Inhibitors to Good Systems Engineering:

## Based on a survey of IT architects and project managers

### ❖ Customer Related Input:

- Isolation from real “user”
- Customer requirements and (even) identity not clear
- Customer doesn’t know what they want
- Scope creep; Undocumented system scope and functionality
- User/buyer too distant
- Don’t understand the customer value system

### ❖ Management Related Input:

- Executive management doesn’t buy in
- Lack of teamwork
- Program Managers not empowered
- Program manager and capture managers are different
- Unstable funding stream; Lack of upper management support

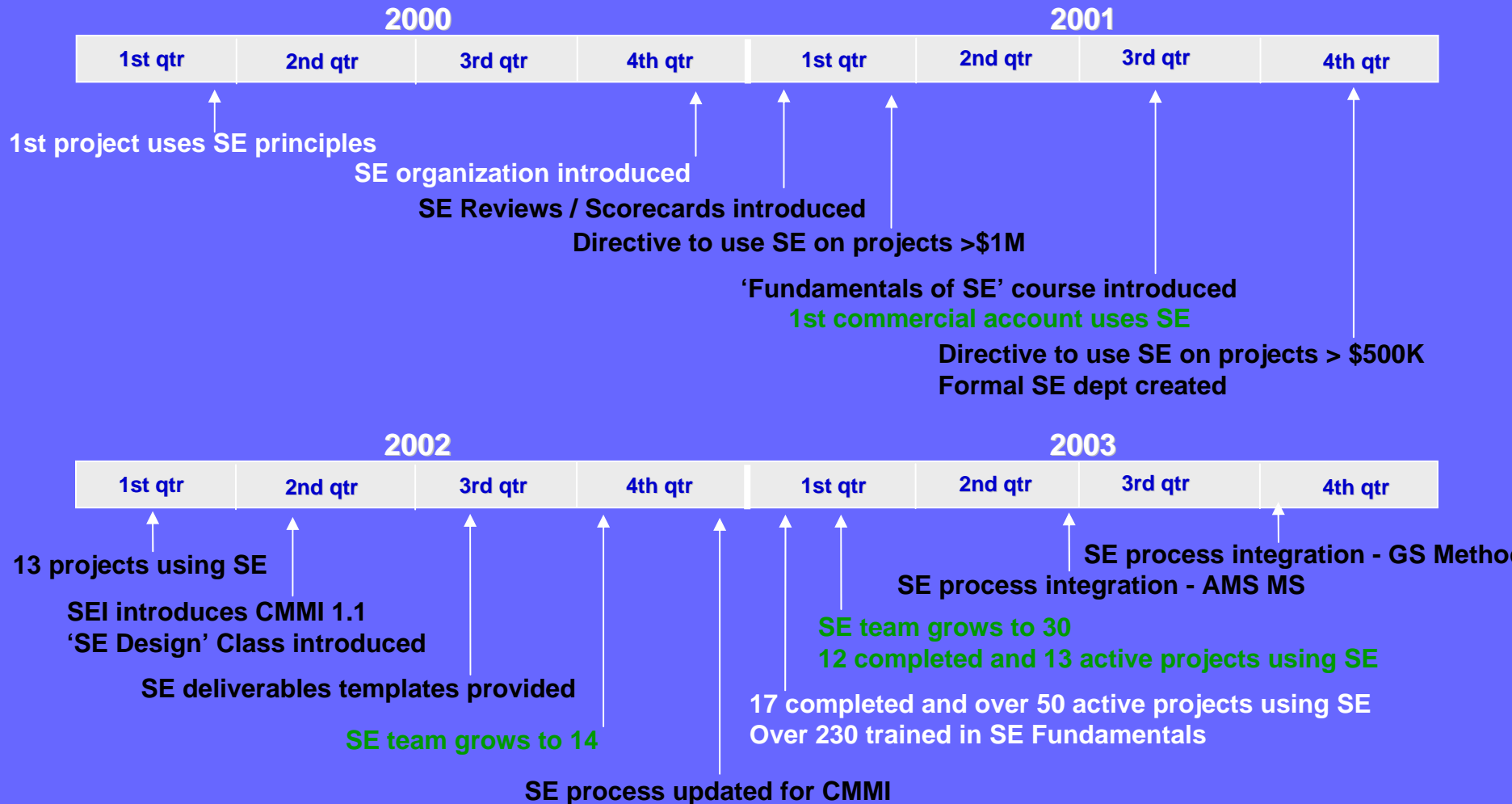
**We would like you to build  
us a lawn mower please!**

### ❖ Organizational/Cultural Input (Some Perceptions):

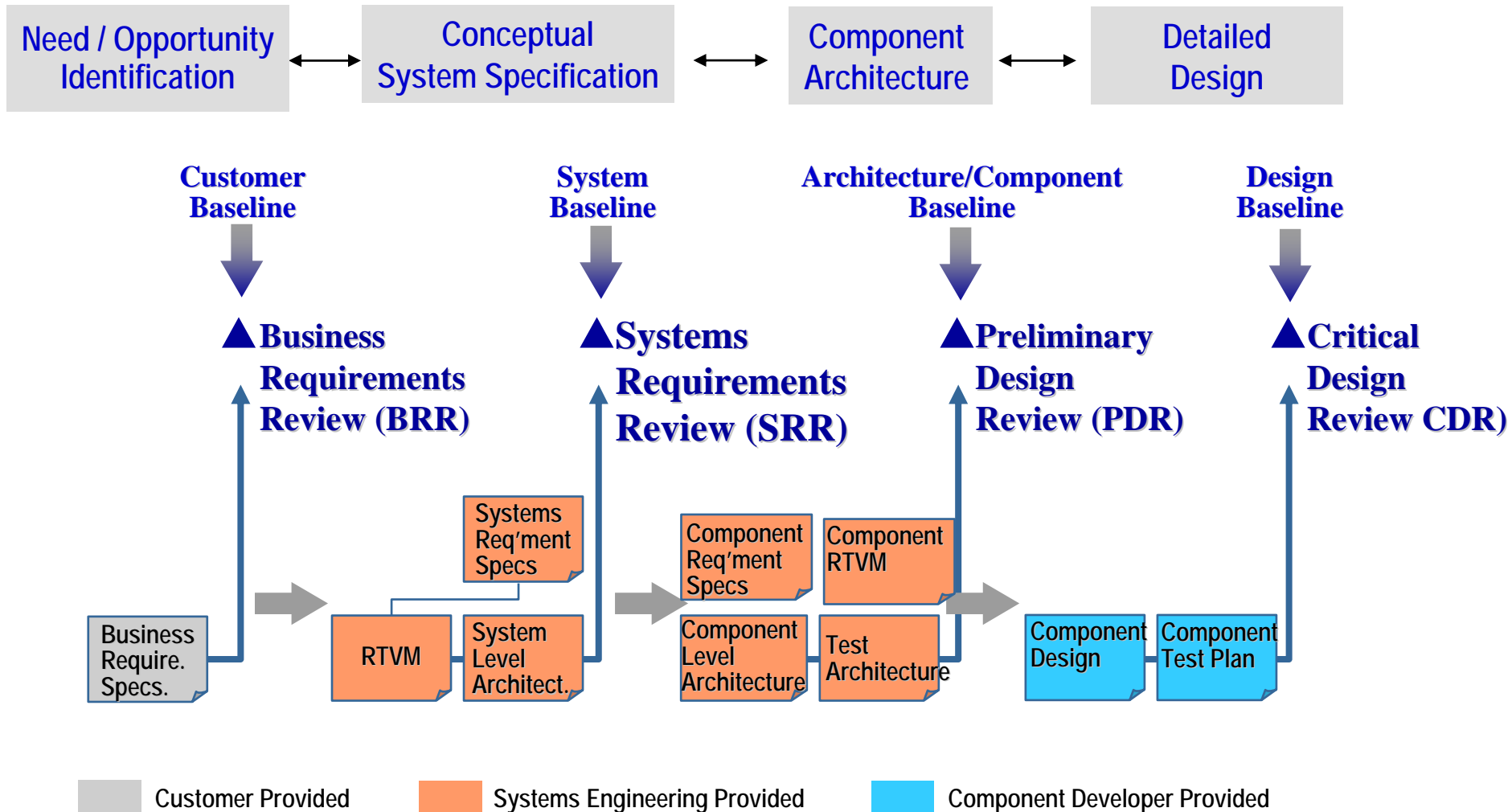
- SEA only adds to the Project Cost
- SEA often seen as an “outside” team or “project reviewer” role

# **Deploying Systems Engineering within a Commercial Global Leader: **Some Results****

# Systems Engineering Has Been Applied to Both Internal and Commercial Accounts

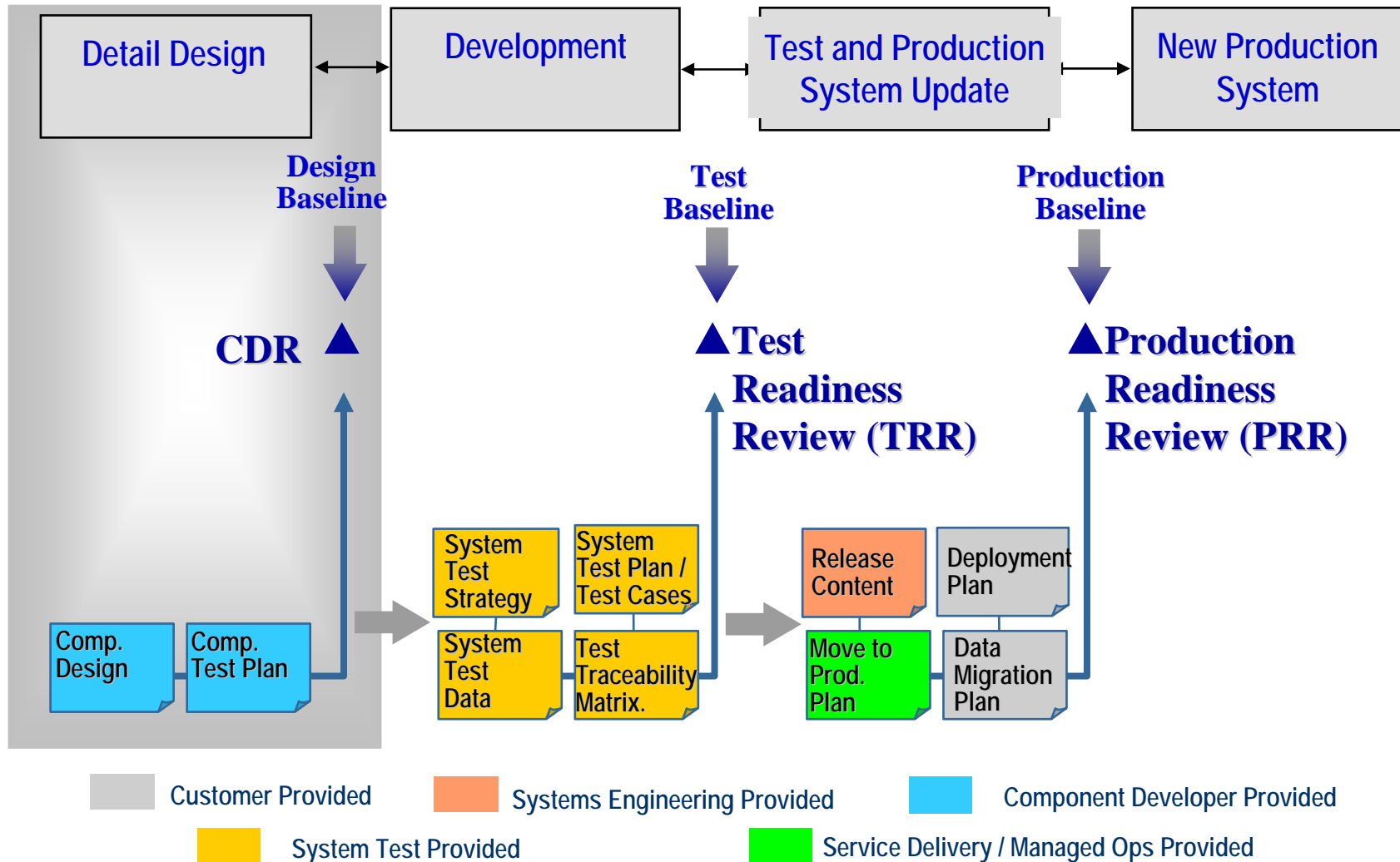


# Systems Engineering Process defines deliverables and a series of Reviews (Part I)





# Systems Engineering Process defines deliverables and a series of Reviews (Part II)

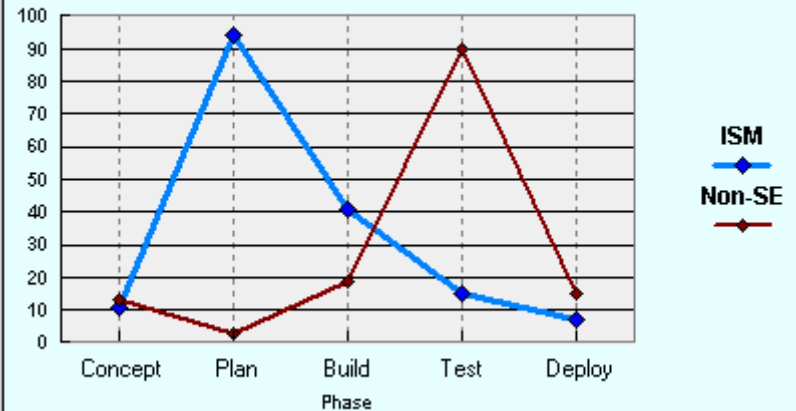


# ISM delivered 5% under budget and with higher quality in production

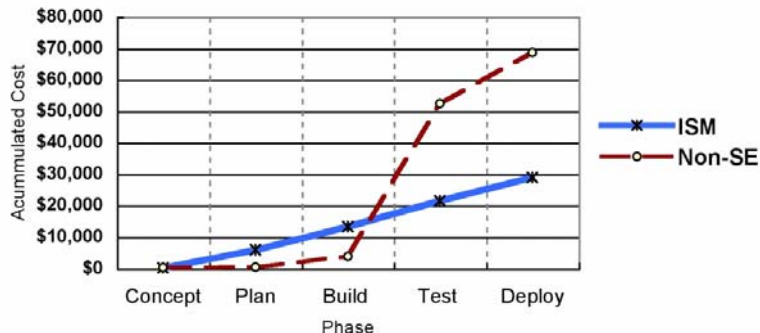
The charts here are based on data collected from a recent study analyzing project defects by type and phase. Here ISM defects by phase is compared to 46 similarly sized projects not utilizing SE.

Total defect counts for non-SE projects exhibited 53.4% of total project defects during the Test Phase of the project. On ISM defects were detected earlier in the project life-cycle. In fact 56% of ISM defects were detected in Plan Phase.

ISM vs. IBM Non SE Project Defect Detection



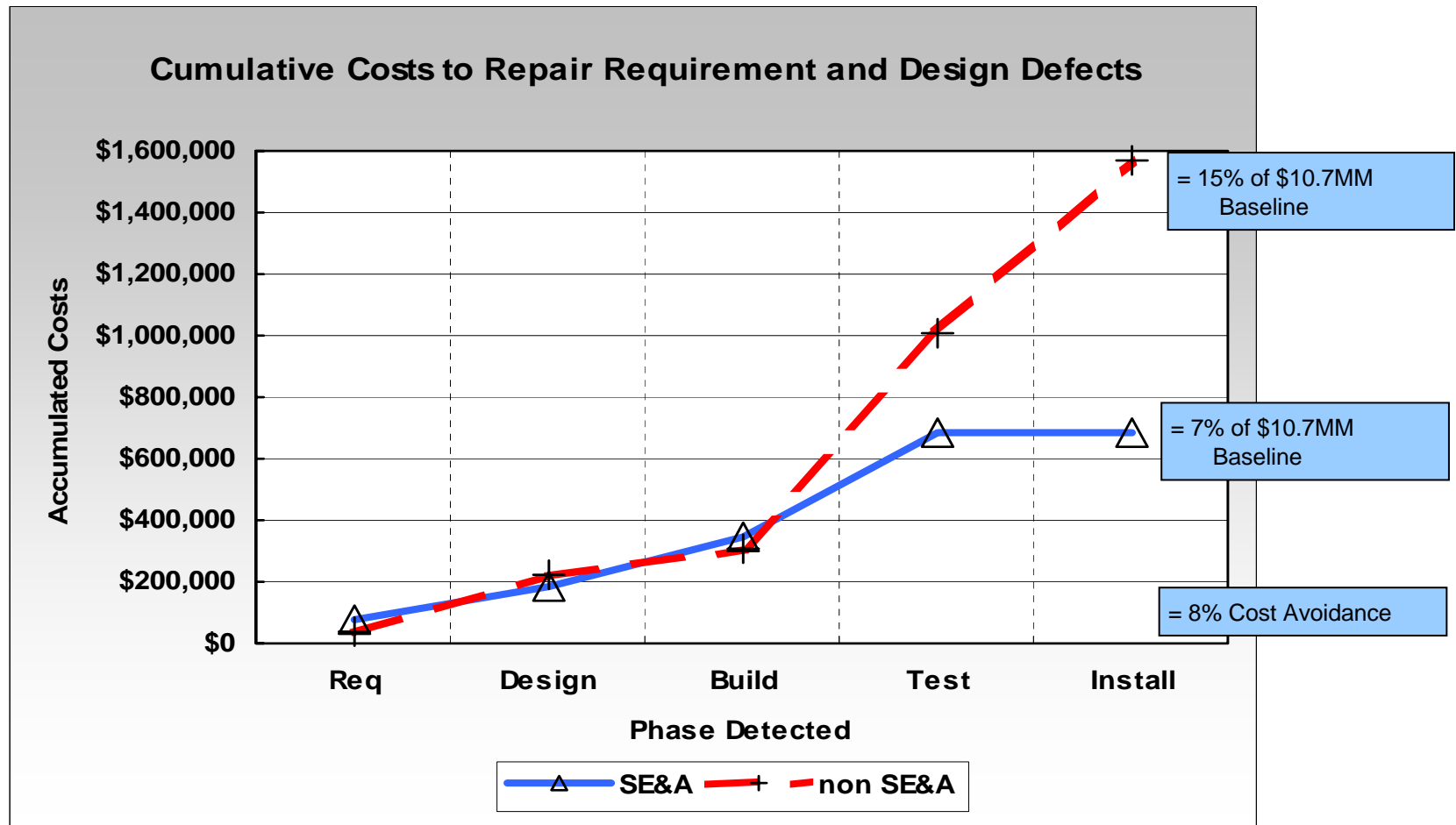
ISM 2.0 vs. IBM Non-SE Projects  
Accumulated Cost of Defects



The chart on the left illustrates the cost implications of early defect detection as found with ISM 2.0.

In effect ISM 2.0 expended 2.4 times less than what would have normally been required for the non-SE oriented projects compared to in the study.

# IGA Metrics show 8% cost avoidance when comparing SE&A projects to non-SE&A projects



## Similar Initiatives Underway at...



# Theory versus (Virtual) Reality...

## Primary Reasons for Dysfunctional Behavior – My Opinion

- ❖ Confusion between “What you NEED” versus “What you WANT”
  - Also called Gold-Plating
  - It is the moral duty of a systems engineer to articulate the resulting cost and schedule delta
- ❖ Confusion with regard to the SYSTEM BOUNDARY
  - This is more difficult for legacy systems with undocumented and implied interfaces; and even more so for “network-centric systems” and “SoS”
- ❖ Confusion (?) with regard to fidelity between the technical project scope and its allocated budget and schedule
  - The result is cynicism and complacency, along with other negative behavioral patterns
- ❖ Lack of Leadership

# Holistic Thinking versus Local Thinking...



# **Wrap-up: Essential Elements of a Systems Engineering Program**

## **❖ Leadership**

- **Policy with Executive Measurements**
- **Investment to develop the process, templates, education, mentoring**

## **❖ Process and tools**

- **Defined Process**
- **Templates**

## **❖ Skilled SEs – Core group of SEs with 15 years experience on major programs**

## **❖ Certification Program**

- **Education**
- **Experience**
- **Examination**

## **❖ Ongoing Process Improvement**